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Differential Pulse Voltammetric Assay of Coffee Antioxidant Capacity with MWNT-Modified Electrode

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Abstract

Multi-walled carbon nanotube-modified glassy carbon electrode (GCE) has shown electrocatalytic activity toward electrochemical oxidation of hydroxycinnamic acids (chlorogenic, caffeic, p-coumaric and ferulic), i.e. decrease of the overpotential on 0.1-0.29 V and two- to threefold increase of oxidation currents in comparison with bare GCE under conditions of cyclic voltammetry. Oxidation of compounds under investigation is a diffusion-controlled process that is confirmed by linear dependence of peak currents on the v1/2 (R2 = 0.9944-0.9998) and peak potentials on the logarithm of v(R2 = 0.9805-0.9996). The differential pulse voltammetry has been applied for the hydroxycinnamic acid quantification. The calibration graphs linearity is continued in 2-5.5 order of concentrations. The approach developed has been utilized for coffee antioxidant capacity (AC) assay based on oxidation of hydroxycinnamic acids containing in coffee beans. Chlorogenic, caffeic and ferulic acids are the contributors to AC that was confirmed by standard addition method. The AC has been expressed in chlorogenic acid equivalents per 100 mL of coffee. AC of instant coffee is statistically insignificant lower than that for ground coffee (148 ± 103 and 197 ± 50 mg per 100 mL, p > 0.05). Positive correlation has been observed between chlorogenic acid equivalent AC of coffee and ferric reducing power based on coulometric titration with electrogenerated hexacyanoferrate(III) ions (r = 0.9602). © 2013 Springer Science+Business Media New York.

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Keywords

Antioxidant capacity, Carbon nanotubes, Coffee, Food analysis, Hydroxycinnamic acids, Voltammetry